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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
09/493,983	01/28/00	YASHIRO H	1018.1117101

MMC1/0822

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EXAMINER	
MULLINS,B	
ART UNIT	PAPER NUMBER
2834	

DATE MAILED: 08/22/01

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

Office Action Summary

Application No.	Applicant(s)
09/493,983	Yashiro et al.
Examiner	**Art Unit**
Burton S. Mullins	2834

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136 (a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) ☒ Responsive to communication(s) filed on Jul 3, 2001 .

2a) ☒ This action is **FINAL.** 2b) ☐ This action is non-final.

3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

Disposition of Claims

4) ☒ Claim(s) 1-27 is/are pending in the application.

4a) Of the above, claim(s) 17-27 is/are withdrawn from consideration.

5) ☐ Claim(s) _____ is/are allowed.

6) ☒ Claim(s) 1-16 is/are rejected.

7) ☐ Claim(s) _____ is/are objected to.

8) ☐ Claims _____ are subject to restriction and/or election requirement.

Application Papers

9) ☐ The specification is objected to by the Examiner.

10) ☐ The drawing(s) filed on _____ is/are objected to by the Examiner.

11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved.

12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119

13) ☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).

a) ☐ All b) ☐ Some* c) ☐ None of:

1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

*See the attached detailed Office action for a list of the certified copies not received.

14) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

BURTON S. MULLINS
PRIMARY EXAMINER

Attachment(s)

15) ☒ Notice of References Cited (PTO-892)
16) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
17) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s). _____
18) ☐ Interview Summary (PTO-413) Paper No(s). _____
19) ☐ Notice of Informal Patent Application (PTO-152)
20) ☐ Other:

DETAILED ACTION

Response to Amendment

1. Applicant's arguments with respect to claims 1-16 have been considered but are moot in view of the new ground(s) of rejection.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 1-7 and 9-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Konno et al. (US 5,089,732) in view of Weilbach et al. (US 5,019,738). Konno teaches the basic spindle motor shaft and cylindrical radial bearing (Fig.6) comprising: cylindrical rotary member 7 attached to rotary shaft 6b; a cylindrical fixed surface 2 surrounding the rotary member 7, wherein the fixed surface 2 is spaced from the rotary member 7 by a predetermined distance (determined by the radial bearing 4); and armature coils 5 arranged about a peripheral surface of the fixed surface 2 to rotate the rotor 6, and thus the shaft 6b.

Konno does not teach that the rotary member has a coefficient of thermal expansion smaller than that of the fixed surface.

Weilbach teaches a motor bearing arrangement comprising a rotary shaft 46 and a surrounding cylindrical bearing sleeve 40 which forms a bearing surface 48 therebetween. As

shown in Table 1 (c.6), the shaft may be of ceramic while the sleeve is of hard anodized aluminum, i.e., alumina or aluminum oxide. Also, the shaft can be of ceramic while the sleeve is steel. Ceramics such as silicon carbide have lower coefficient of thermal conductivity, usually 3-4 x 10^{-6}/°C, smaller than the thermal conductivity of most steels, e.g. 110 to 170 x 10^{-6}/°C (see http://www.sni.net/~fjlawson/matlprops.html#thermal_exp). The combinations in Table 1 of Weilbach are successful bearing arrangements which conform to roughness profiles that provide high precision bearings with various beneficial operating characteristics such as high stiffness, low velocity lift, etc. (c.2, lines 23-64).

It would have been obvious to one having ordinary skill in the art to provide a ceramic material with a low coefficient of thermal expansion per Weilbach as the material for the cylindrical rotary member of Konno since this would be desirable to provide a high precision bearing.

Regarding claim 2, the difference in thermal expansion between ceramic and a typical steel as taught in Weilbach is much greater than the claimed minimum value.

Regarding claims 3 and 9, the value for a typical ceramic such as silicon carbide used as the rotating shaft in Weilbach is typically 3-4 x 10^{-6}/°C .

Regarding claims 4-5, hard anodized aluminum, or alumina, is taught as the sleeve surface in Weilbach.

Regarding claims 6-7 and 10-11, note that the rotary member in Weilbach can be made of a ceramic. Ceramics include ceramic carbide material such as silicon carbide (see Konno '173, c.14, lines 65-67).

4. Claims 8 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Konno et al. (US 5,089,732) and Weilbach as applied to claims 1 and 9 above, and further in view of either Becker (US 2,545,335) or Yassemi (US 4,284,917). Neither Konno nor Weilbach teach a case accomodating the bearing, rotary member and fixed surface, wherein the case has a slit for cooling these elements.

Becker teaches a motor including a case 2 surrounding the stator windings and rotor. The case includes openings or "slits" 6 which cools the motor (c.1., line 52-c.2, line 3).

Yassemi teaches a motor including a case or inner housing 13 surrounding the stator, rotor and bearings. Blind openings or "slits" 47 in the case (Figs.1-2) allow cooling water to transmit heat away from the bearings and stator (c.3, lines 47-52).

It would have been obvious to one having ordinary skill in the art at the time of the invention to modify the structure of Konno and Weilbach and provide a case accomodating the bearing with slits or openings per Becker or Yassemi since it would have been desirable to cool the motor.

5. Claims 13-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Konno et al. (US 5,089,732) in view of Weilbach et al. and Yashiro (JP 2-16389). As discussed above, Konno teaches the general cylindrical bearing structure.

Konno does not teach that the rotary member has a coefficient of thermal expansion smaller than that of the fixed surface. Neither does Konno teach a turbo-molecular pump, per se.

Regarding the former feature, Weilbach teaches a motor bearing arrangement comprising a rotary shaft 46 and a surrounding cylindrical bearing sleeve 40 which forms a bearing surface 48

therebetween. As shown in Table 1 (c.6), the shaft may be of ceramic while the sleeve is of hard anodized aluminum, i.e., alumina or aluminum oxide. Also, the shaft can be of ceramic while the sleeve is steel. Ceramics such as silicon carbide have lower coefficient of thermal conductivity, usually 3-4 x 10^{-6}/°C , smaller than the thermal conductivity of most steels, e.g. 110 to 170 x 10^{-6}/°C (see http://www.sni.net/~fjlawson/matlprops.html#thermal_exp). The combinations in Table 1 of Weilbach are successful bearing arrangements which conform to roughness profiles that provide high precision bearings with various beneficial operating characteristics such as high stiffness, low velocity lift, etc. (c.2, lines 23-64).

Regarding the latter feature, Yashiro teaches a turbo-molecular pump including rotor 17, rotor vanes 16, stator or housing 11, stator vanes 19, and motor 13/14 for rotating the rotor. Yashiro also teaches non-contact, ceramic cylindrical bearings (Figs.4-5; specification, p.1-p.4) for radial and thrust bearings. A fan is also included for cooling the air bearing, as discussed at p.3, line 27 of the specification with regard to Yashiro.

It would have been obvious to one having ordinary skill in the art to provide a ceramic material with a low coefficient of thermal expansion per Weilbach as the material for the cylindrical rotary member of Konno since this would be desirable to provide a high precision bearing. It would furthermore have been obvious to employ the bearing on a turbo-molecular pump because high precision would be desirable in high-speed applications such as the turbo-pump in Yashiro, which also uses cylindrical bearings.

Conclusion

6. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Burton S. Mullins whose telephone number is (703) 305-7063.

bsm

August 20, 2001

BURTON S. MULLINS
PRIMARY EXAMINER